

- IV.—On certain Earthworms from the Western Himalayas and Dehra Dun.—By ALFRED GIBBS BOURNE, D.Sc. (Lond.), C.M.Z.S., F.L.S., Fellow of University College, London, and Madras University. Communicated by THE SUPERINTENDENT OF THE INDIAN MUSEUM.

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(With Plate III.)

Introduction.—These specimens were collected and placed in my hands for examination by Mr. J. Wood-Mason, Superintendent of the Indian Museum, Calcutta. They come from two localities, Dehra Dun and Masouri. Dehra Dun lies at the foot of the Western Himalayas and at a great elevation. Masouri lies at an elevation of 5—6000 feet on the southern slopes of the Western Himalayas.

The worms from Dehra Dun belong to the three genera *Perichæta*, *Perionyx*, and *Typhæus*. There is one species of each of these genera. The *Perichæta* is *P. houletti*, E. Perrier. The specimens of *Perionyx* are none of them in a sufficiently mature condition to enable me to characterize the species; they differ in the shape of the setæ and in colour from *P. saltans*, Bourne; neither can they be referred to *P. excavatus*, E. Perrier; nor to *P. n'intoshi*, Beddard. The *Typhæus* I have referred to a new species, *T. masoni*. The worms from Masouri include three species of *Lumbricus*, or at any rate of some genus or genera of the *Lumbricidæ*, and two species of *Perionyx*. The specimens of the latter are, like the specimens of *Perionyx* from Dehra Dun, immature, and do not moreover appear to belong to any of the hitherto described species of this genus. I refrain from naming the species of *Lumbricus*, because I could only give an incomplete description and thus hamper any future observer who obtains them in a fresh condition. The literature with regard to the genera and species of the *Lumbricidæ* is already in great confusion. I am now acquainted with seven distinct species belonging to this family which occur in India.

We have not at present many data with respect to the relation between the altitude and the worm fauna.

I have stated* that *Perichæta stuarti* is to be found at an elevation, of 5000 ft. and also at one of 1000 ft., but this has proved to be a mistake which arose from my collector having mixed specimens from the two localities. I cannot find *P. stuarti* at any great distance down the ghaut.

* On Indian Earthworms, Part I. Preliminary Notice of Earthworms from the Nilgiris and Shevaroy's. Proc. Zool. Soc. 1886, p. 667.

Fletcher* has recorded specimens of the same species of worm from different altitudes, e. g., *Lumbricus nova-hollandia* from the sea-level at Sydney and from 2,700 ft. at Capertee; *Perichæta exigua* from the sea-level near Sydney and from Springwood on the Blue Mountains.

There is, I presume, nothing like the difference in climate between these Australian localities that exists between that of any hill-station in India and of the plains. So far as my observations go all the species from hill-stations differ from those of the plains. I have found species of *Perichæta*, *Acanthodrilus*, and *Moniligastra* on the hills and other species in the plains, but I have never found *Lumbricus* in the plains. I do not know how far the present collection is an exhaustive one from the district, but so far it appears that *Typhaeus* is confined to the plains or moderate elevations, while there is an undoubted *Perionyx* from Dehra Dun, and of the three species of *Perionyx* previously described *P. saltans* comes only from considerable elevations, *P. excavatus* and *P. m'intoshi* come presumably from the plains, so that the genus *Perionyx* is also to be found at varying elevations.

None of the species in the present collection are identical with any which I have hitherto found in Southern India.

PERICHÆTA HOULLETI.

I do not propose to give any lengthy account of this worm without examining it in a fresh state. It is the less necessary to do so as the existing accounts enable one to recognise it with great certainty. It was originally described by Perrier,† and Beddard subsequently published two notes upon the species.

In one‡ of these he has described the setæ which are placed on the clitellar somites as much smaller than the setæ of the "anterior pre-clitellar" somites, and states that they terminate in a "distinctly bifid extremity; the two points in which the seta ends diverge at a considerable angle from each other, but are connected by a delicate membrane. The opposite extremity of the seta, which is imbedded in the body wall, is abruptly truncated. The whole seta has not the S-shaped curve, which is so constant a character in the group, but is curved only in one direction. As in the other setæ of the same species, and in the setæ of earthworms generally, the middle part is somewhat thicker; but this region does not lie in the middle of the

* Notes on Australian Earthworms. Proc. Linn. Soc. N. S. W. 1886, p. 545; 1887, p. 387.

† E. Perrier, Recherches pour servir à l'Histoire des Lombriciens Terrestres, Nouv. Arch. d. Mus. t. viii, 1872.

‡ Proc. Zool. Soc. 1887, p. 389.

setæ, but is closely approximated to the posterior extremity; the part of the seta which lies behind the dilated region is straight. The general shape of these clitellar setæ, apart, of course, from the bifid extremity, is like that of imperfectly developed ordinary setæ. That this is not really the case with these setæ is, however, clearly shown by the fact that all the setæ of the several rows comprised in the clitellum have precisely the same shape, and also by the fact that in two specimens of the worm, which were the first that came to hand, the structure of these clitellar setæ was precisely identical."

The ordinary setæ present also some variations in size. The seta immediately on either side of the median ventral line is usually if not always larger than the others. The setæ on the clitellar somites in my specimens agree with the minute description quoted above.

Perrier states that the gizzard occupies somite IX, but I have found that the septa separating somites VIII—IX and IX—X are absent, so that the gizzard may be said to occupy somites VIII, IX, X. This is the position ascribed to the gizzard in *P. feei*, *P. indica*, *P. peregrina*, and is moreover its probable position in *P. sieboldi*, *P. japonica*, *P. musica*, and *P. annulata*. These are all worms possessing other special characters in common, and further investigation will probably add to the list *P. affinis*, *P. birmanica*, *P. sumatrana*, *P. hasselti*, *P. robusta*, *P. aspergillum*, *P. quadragenaria*, *P. elongata*, *P. schmurdaei*, *P. capensis*, and, possibly, *P. queenslandica* and *P. darnleiensis*.

The organs described by Perrier as testes are doubtless seminal reservoirs; in position and structure they agree with these organs in so many other worms. I have not, however, been able to find the true testes, but could doubtless do so in fresh specimens. The spermathecae and prostates have been described and figured by Perrier. I have figured them in Pl. III, Figs. 4 and 5. The number, position, and structure of the spermathecae have been largely used as specific characters. The structure of the prostate glands is a character of no less specific importance.

TYPHEUS MASONI, sp. n.

External characters.—Length 130 m.m.; width 6 m.m. Prostomium is short and broad and can be retracted so as to be hidden by the first or buccal somite. The latter is but very slightly marked off from the second somite and is as usual devoid of setæ. The other pre-clitellar somites consist of two, three, or even four annuli.

The clitellum when fully developed extends completely round the body in somites XIV, XV, XVI, nearly the whole of XVII, and a small portion of XIII.

The clitellum presents ventrally a very curious appearance owing to the structures about to be described. Between somites XV and XVI, and also between somites XVI and XVII, there is a pair of oval depressions in the middle of each of which stands a little papilla. Between somites XIX and XX there are similar structures, but the depressions are much less marked and the whole thing is smaller. These structures are a very little further from the ventral median line than are the ventral pair of setæ on each side. The male pores are placed in somite XVII a little further still from the median ventral line; they are on papillæ which lie in very deep pits. These structures are shewn in Pl. III, Fig. 1.

The oviducal pores are placed anteriorly to the setæ in somite XIV; they are separated from one another.

The spermathecal pores are very well marked slit-like apertures placed between somites VII and VIII; they lie nearer the middle line than do setæ 3.* The dorsal pores, intersomically placed, are visible behind the clitellum; they are especially well marked at the posterior end of the body.

Nephridiopores are not visible. There are eight setæ in each somite; they are confined to the ventral surface of the body. Their arrangement in eight longitudinal rows is what chiefly strikes one on examining a spirit specimen. In about the anterior two-thirds of the body setæ 1 and 2, and 3 and 4, lie nearer to one another than do setæ 2 and 3, that is to say, the setæ are placed in couples, but this arrangement gradually changes and in about the posterior third of the body the eight setæ still lying in a row on the ventral surface are almost equidistant from one another. The ventral gap remains however a trifle wider than the interspace between any two setæ.

The full complement of setæ is present in the clitellum, but in somite XVII setæ 1 and 2 are replaced by the groups of penial setæ described below.

Septa.—The most anterior septum is septum IV—V (*i. e.*, the septum which forms the boundary between somite IV and somite V). This and septum V—VI are very thick being exceedingly muscular. The next septa which are developed are, I think, septa VIII—IX, IX—X, and X—XI. Those are all fairly muscular and placed close together, that is to say, they do not correspond in position with the external divisions between the somites. It is therefore exceedingly difficult to

* I adopt the convenient system of numbering the setæ suggested by Benham, seta 1 being the seta which lies nearest the median ventral line on either side; seta 2 the seta immediately beyond seta 1 and so on.

state with certainty which segments they really bound. All the remaining septa are very thin.

Alimentary Canal.—The mouth occupies the usual position and when the prostomium is protruded is overhung by it, but, as stated above, the prostomium can be retracted so as to be completely hidden by the buccal somite; the mouth then appears to be terminal.

The buccal cavity and pharynx resemble those of *T. orientalis*.

The gizzard has precisely the structure described for that species. It is "divided into two portions an anterior small thin-walled compartment and a large thick-walled portion, the gizzard proper, this last has a nacreous appearance on the outside and is lined by a very thick chitinous layer." It lies between septum V—VI and septum VIII—IX and thus extends over three somites (VI, VII, VIII). Muscular bands are attached to the walls of the gizzard and pass to the body wall.

The alimentary canal is considerably dilated in somite XI or XII, a pair of oesophageal glands being present. From the gizzard up to this dilated oesophagus is narrow, and beyond the latter, until it widens out at about somite XVI, it is also narrow.

There are four pairs of glandular bodies placed on the intestine in the hinder region of the body. They are all bi-lobed and lie below the dorsal vessel and not above it. (Beddard states that they lie above the dorsal vessel in *T. orientalis*.)

Nephridia.—There are large tufts of nephridial tubules in the pharyngeal region and a series of smaller tufts in the other pre-clitellar somites. I have especially noted the tufts which are placed near the spermathecal ducts. I am unable, from the specimens I have, to enter into further details with regard to the nephridia, but I have observed nothing which differs from Beddard's account of these organs in *T. orientalis* and *T. gammi*.

Generative organs.—I am anxious to examine other specimens before giving a full account of these organs.

A pair of ovaries are present in the usual position in, I believe, somite XIII, but the specimens being very contracted in this region it is impossible to be quite certain as to the number of any particular somite. The oviducts open to the exterior by a pair of pores placed in the anterior half of somite XIV.

I have been unable to see the testes.

I have found a single pair only of seminal reservoirs and near them a pair of bodies with a nacreous appearance which seem to be ciliated rosettes, as, connected with these, I find the vasa deferentia.

I cannot be quite certain, but apparently both the seminal reservoirs and the ciliated rosettes belong to somite XI; as mentioned above, the

septum which I have calculated to be septum X—XI is a thick one, and they certainly lie posterior to it. The seminal reservoirs are very large and extend backwards over three or four somites.

The prostates (I reserve for the present any expression of opinion as to the desirability of retaining this term or substituting for it the term atria) are large and lie one on either side of the body. Each consists of an irregularly coiled, almost orange-coloured, glandular tube which is connected at one end with a muscular duct opening to the exterior in somite XVII. The vas deferens is connected with this just before it penetrates the body wall. There is a muscular sac containing several very long and slender penial setæ; these project from the little papilla which lies in the depression round the male pore. These setæ are shewn in Pl. III, Fig. 3. There are two varieties, one of which is nearly a quarter of an inch in length and much longer than the other.

There is a single pair of spermathecae, the apertures of which lie between somites VII and VIII, as shewn in Pl. II, Fig. 1. Each spermatheca is large, somewhat reniform in shape, and has arising from the hilus a short, very stout and muscular efferent duct. Opening into the duct near the hilus is a pair of diverticula. One of these is so deeply bi-lobed as to almost form two separate little sacs, while the other is slightly tri-lobed. Both have a very nacreous appearance which is not possessed by the spermatheca itself.

General Remarks.—There can be no doubt but that this worm belongs to the genus *Typhæus*, Beddard. Two species of this genus have been described, *T. orientalis** and *T. gammi*.†

I should have hesitated about placing this worm without further information in a separate species had not Beddard described this second species *T. gammi*; but this worm differs as much from either *T. orientalis* or *T. gammi* as these latter do from one another. Beddard denies the existence of a prostomium. If this is non-existent it is a very remarkable fact. Beddard states that setæ 3 and 4 are absent from the somites which form the clitellum in *T. orientalis*. He does not mention their presence or absence in speaking of *T. gammi*. They are present in my species, although not always visible on a mere external examination. Beddard says nothing with regard to the arrangement of the setæ in the posterior region of the body, so that I am justified in concluding that the arrangement which I have noted is peculiar to my species; it gives the worm such a striking appearance that one could hardly fail to notice it. Beddard does not mention œsophageal glands as present in either *T. orientalis* or *T. gammi*.

* Beddard, Ann. & Mag. Nat. Hist. ser. 4, vol. xii, 1883.

† Beddard, Quarterly Journ. Microsc. Science, vol. xxix, 1888.

There is still some doubt, I think, with regard to the position of the septa in all species, and, until this is resolved, it is difficult to fix the position of the testes, seminal reservoirs, and ciliated rosettes. Beddard states that in *T. gammi* the two most anterior septa are septa IV—V and V—VI; that one septum, presumably VI—VII, is absent and that "farther back are three thickened septa which lie between segments VIII, IX and X." Now, I believe, that in ascribing a position to the internal organs we should determine the somite by the septa which bound it. It is true that the septum often appears to have a position which is not in accordance with the limits of the somites as marked externally, but this may be seen in longitudinal sections to be due to the fact that the muscular fibres of the septum adhere for some little distance, either backwards or forwards, to the body wall. Beddard's statement that three septa lie between three "segments" is misleading. Three septa bound two somites. I would interpret the "three thickened septa" mentioned above as septa VIII—IX, IX—X, and X—XI. If this be the case the single pair of testes and ciliated rosettes lie in somite XI. According to Beddard's account of *T. gammi* they lie in somite X, while judging from his figure they would appear to be in somite XII.

I propose to define the present species as follows:—

T. masoni.—Penial setæ of two varieties lying together in the same sac; the one variety very long, with a slight S-shaped curve and a sub-terminal dilation at the distal extremity, while the proximal extremity presents irregular transverse markings; the other variety shorter, somewhat spear-shaped, the distal extremity flattened and furnished with obscurely marked chevron-shaped ridges.

The setæ in about the posterior third of the body are not arranged in couples as in the anterior two-thirds, but are equi-distant from one another, the ventral gap being slightly larger than the interspace between any two setæ.

The spermathecae are provided with two diverticula, the one bifid the other obscurely trifid.

I do not suggest any modifications of Beddard's definition of the genus, but expect that some will be ultimately necessary. As far as we know, neither the character of the diverticula of the spermathecae nor the number of these organs themselves is of generic value. The number of intestinal glands probably varies in different species, and, further, I am not quite sure about the position of the testes.

EXPLANATION OF PLATE III.

Fig. 1. *Typhæus masoni*. Ventral view of the anterior somites. *m.* mouth; *sp.* spermathecal pore; ♀. oviducal pores; ♂. male pores; $p^1p^2p^3p^4$. copulatory papillæ; *c.* clitellum. The roman numerals indicate the numbers of the somites.

Fig. 2. Prostate gland, etc., of the left side from the same worm. *ext.* aperture to the exterior (male pore); *v. d.* vas deferens; *m. d.* muscular duct of the prostate gland; *pr.* the prostate gland; *p. s.* sac containing penial setæ.

Fig. 3. Penial setæ from the same worm. One of each of the two varieties *a.* and *b.* is drawn.

Fig. 4. *Perichæta houlleti*. Prostate gland of the left side. *ext.* aperture to the exterior; *m. d.* muscular duct; *pr.* prostate gland.

Fig. 5. Spermatheca of the same worm seen turned forwards. *sp.* Spermathecal sac proper; ap^1 . large cæcal diverticulum; ap^2 . small cæcal diverticulum.

